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भारतीय मानक

धातुओं और मिश्र धातुओं का संक्षारण — पर्यावरण की संक्षारणता के मूल्यांकन के लिए मानक नमूनों की संक्षरण दर निर्धारण करने की पद्धतियाँ

Indian Standard

CORROSION OF METALS AND ALLOYS — DETERMINATION OF CORROSION RATE OF STANDARD SPECIMENS FOR THE EVALUATION OF CORROSIVITY — METHODS OF

ICS No. 77·060

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

October 1995 **Price Group 1**

Corrosion Protection Sectional Committee, MTD 24

FOREWORD

This standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Corrosion Protection Sectional Committee had been approved by Metallurgical Engineering Division Council.

The characterization of an atmospheric corrosion test site or of a service location with respect to its corrosivity can be accomplished by determining the corrosion rate of standard specimens exposed for one year to the atmosphere at the respective location (direct corrosivity evaluation). The standard specimens are flat plate or open helix specimens of the four standard structural marerials, aluminium, copper, steel, and zinc. These methods represent an economical way for corrosivity evaluation taking into account all local environmental influences.

The standard is based on ISO 9226 'Corrosion of metals and alloys — Classification of corrossivity of atmospheres', prepared by International Organisation for Standardisation.

In reporting the result of a test or analysis made in accordance with this standard, if final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

CORROSION OF METALS AND ALLOYS — DETERMINATION OF CORROSION RATE OF STANDARD SPECIMENS FOR THE EVALUATION OF CORROSIVITY — METHODS OF

1 SCOPE

1.1 This standard specifies the methods which can be used for the determination of corrosion rate with standard specimens.

1.2 The values obtained from the measurements (corrosion rates after the first year of exposure) are to be used as classification criteria for the evaluation of atmospheric corrosivity according to IS 14191 : 1995.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
5555 : 1970	Code of procedure for conducting field studies on atmospheric corrosion of metals
14191 : 1995	Corrosion of metals and alloys — Classification of corrosivity of atmosphere

3 PRINCIPLE OF THE METHODS

The corrosivity of each of the exposure locations or the industrial installation sites is deduced from the corrosion rate calculated from the loss of mass per unit area of standard specimen following the descaling of corrosion products from the specimens after exposure periods of one year.

It should be noted that aluminium (99·5 percent) can experience pitting corrosion in the atmosphere but that for the purposes of this standard the corrosion rate is calculated as if the corrosion was uniform.

4 STANDARD SPECIMENS

4.1 Two types of standard specimen may be used. The materials used to prepare the standard specimen are of current fabrication, that is:

Steel : Unalloyed Carbon Steel (Cu 0·03-0·10 percent, P $<$ 0·07 percent)
Zinc : 98·5 percent, *Min*
Copper : 99·5 percent, *Min*
Aluminium : 99·5 percent, *Min*

4.2 Flat Plate Specimens

The specimens are rectangular plates with dimensions of preferably 100 mm × 150 mm at least 50 mm × 100 mm with a thickness approximately 1 mm.

4.3 Open Helix Specimens

The materials used to prepare the standard specimens are wires intended for thermal spraying.

Wires with a diameter, *d*, of 2-3 mm are out to a length of approximately 1 000 mm. They are then rolled into a helix using a rod with a diameter of 24 mm. Open helix specimen assembly is given in Fig. 1 for guidance.

5 EXPOSURE OF STANDARD SPECIMENS

5.1 The preparation and the exposure of the weighed and marked standard specimens shall be done as per IS 5555 : 1970.

5.2 Three specimens of each metal should be exposed for one year period starting in the beginning of the worst corrosive period of the year. Helix specimens must be exposed in upright position.

5.3 After exposure the corrosion products formed on specimens are removed as IS 5555 : 1970 and reweighed to the nearest 0·1 mg. The cleaning procedure should be repeated on specimens several times in equal cleaning cycles.

6 EVALUATION OF RESULTS

6.1 The corrosion rate, r_{corr}, for each metal, expressed in g/(m²·a) is given by:

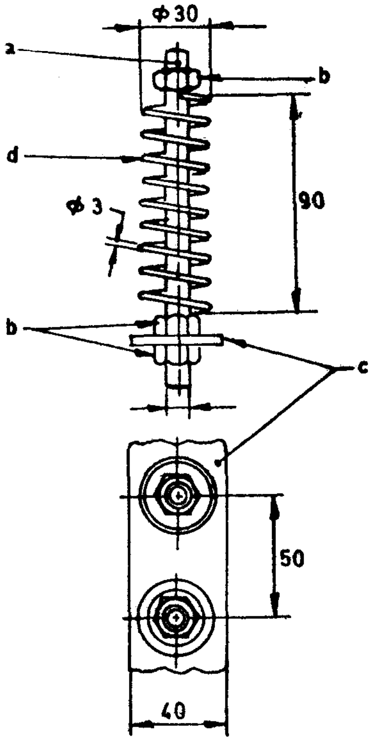
$$r_{corr} = \frac{\Delta m}{A \times t} \quad \ldots\ldots (1)$$

where

Δm = mass loss, in grams;

A = surface area, in square metres; and

t = exposure time, in years.



a — Polyamide Holder
b — Fixing Nut
c — Metallic Support
d — Wire

FIG. 1 OPEN HELIX SPECIMEN ASSEMBLY

The corrosion rate, r_{corr}, can be expressed in µm/a and calculated according to:

$$r_{\text{corr}} = \frac{\Delta m}{A \times \rho \times t} \quad \ldots \text{(2)}$$

where

ρ = density, in grams per cubic centimeter, of the metals as given below:

$\rho_{Cu} = 8{\cdot}96\ \text{g/cm}^3$

$\rho_{Fe} = 7{\cdot}86\ \text{g/cm}^3$

$\rho_{Zn} = 7{\cdot}20\ \text{g/cm}^3$

$\rho_{Al} = 2{\cdot}70\ \text{g/cm}^3$

t = exposure time, in years

other symbols are identical with the symbols in equation (1).

The corrosion rate for open helix specimens, r_{corr}, in µm/a can be culculated according to:

$$r_{\text{corr}} = 0{\cdot}25\ \frac{\Delta m \times d}{m \times t}$$

where

Δm = mass loss, in milligrams;

d = wire diameter, in millimetres;

m = original mass, in grams; and

t = exposure time, in years.

In the test report all single values and the mean values have to be reported.

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This Indian Standard has been developed from Doc No: MTD 24 (3770).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at New India Printing Press, Khurja, India